Preliminary Energy Savings Analysis of Standard 90.1R

Pacific Northwest National Laboratory

Presented to SSPC 90.1

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Analysis Objectives

- Provide *preliminary* look at energy impacts
- Maintain objectivity in the approach
- Retain consistency with the criteria development work (including the National Energy Model)
- Use assumptions that are both defensible and documented
- Focus on the major energy uses that can be modeled effectively

Major Assumptions

- Offices and retail buildings only
- Three-story, 15-zone prototype
- Metal frames and mass walls
- Packaged single zone unitary cooling equipment with furnace
- Economizers based on 7.5 Ton units
- 11 original climate locations

Preliminary results based on:

- Construction volume weighting used for combining climate locations
- 90/10 split for gas/electric resistance furnaces
- 50/50 mix of mass and metal frame walls

Preliminary study based on two highest energy use building types

Principal Building Activity	Annual Energy Use	Percent of Total
Office	*1,019*	19.1%
Mercantile and Service	*973*	18.3%
Education	614	11.5%
Health Care	561	10.5%
Lodging	461	8.7%
Public Assembly	449	8.4%
Food Service	332	6.2%
Warehouse and Storage	325	6.1%
Other	173	3.3%
Food Sales	137	2.6%
Public Order and Safety	124	2.3%
Religious Worship	104	2.0%
Vacant	51	1.0%
Total	5,323	100.0%

Source: CBECS95 Table 1. Sum of Major Fuel Consumption by End Use (Trillion Btu)

Modeled Systems

What is in?

- Envelope
- Interior Lighting
- HVAC
  - Equipment Efficiencies
  - Economizers
- Service Water Heating
- Plug Loads
- Infiltration

What is out?

- Elevators
- Cooking
- Exterior Lighting

*(Items not modeled in either 90.1-1989 or 90.1R)*

Basis for Energy Savings Estimates

- Savings based on utilization index comparison between 90.1R and 90.1-1989
- Utilization indices calculated as annual energy or dollars per square foot of conditioned area
- Use of the utilization index allows comparisons across building size and use

Utilization Indices Reported

- *Site EUI* - classical method for reporting energy use based on the consumption measured at the customer's site

- *Source EUI* - coverts energy used at the site to a source equivalent to account for losses (electricity source conversion of 10,301 Btu/kWh)

- *Energy Cost (ECI)* - reflects the costs the customer would pay by multiplying site energy use by the assumed utility rates ($.08/kwh, $.56/therm)
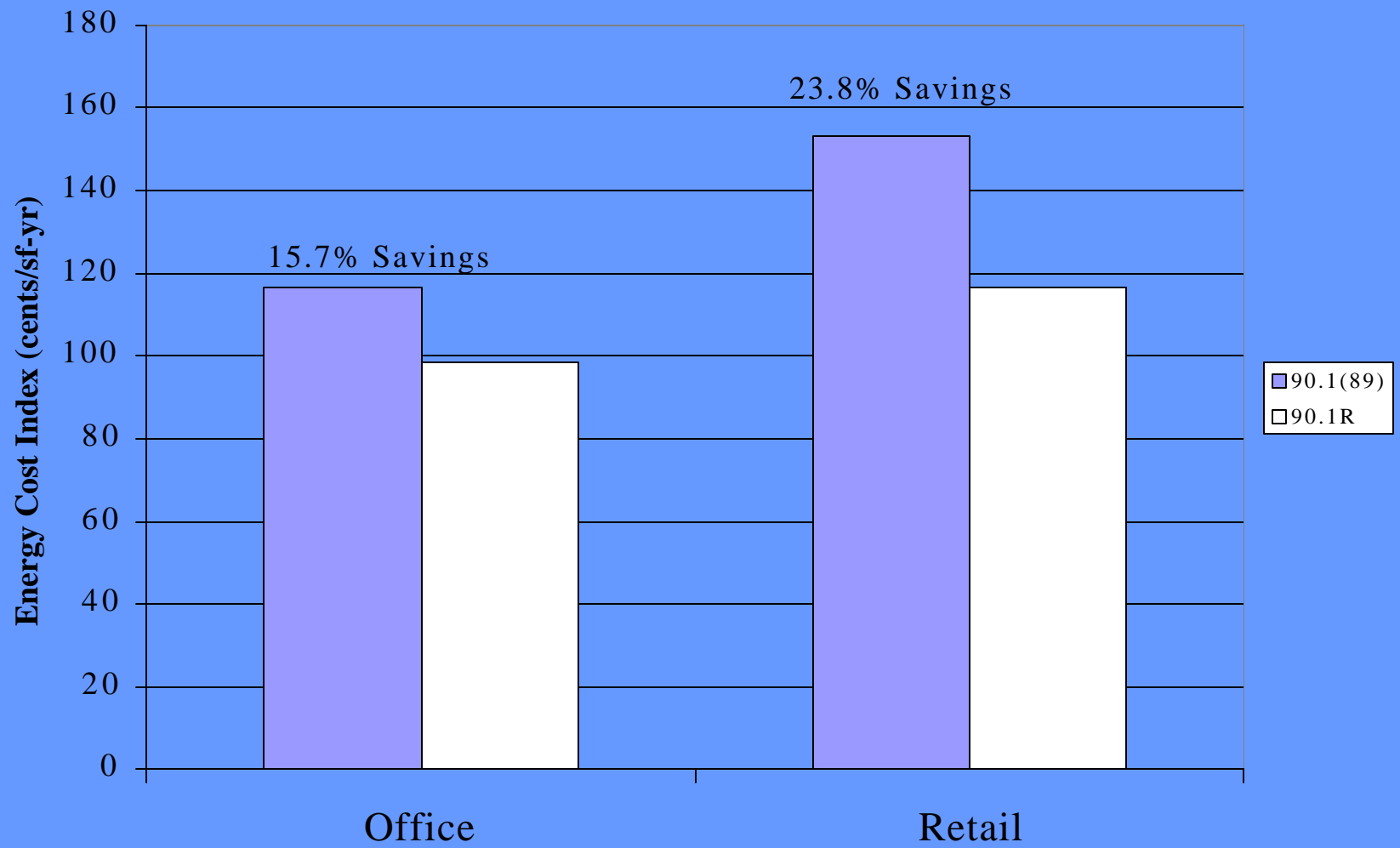
Combined Office and Retail Savings
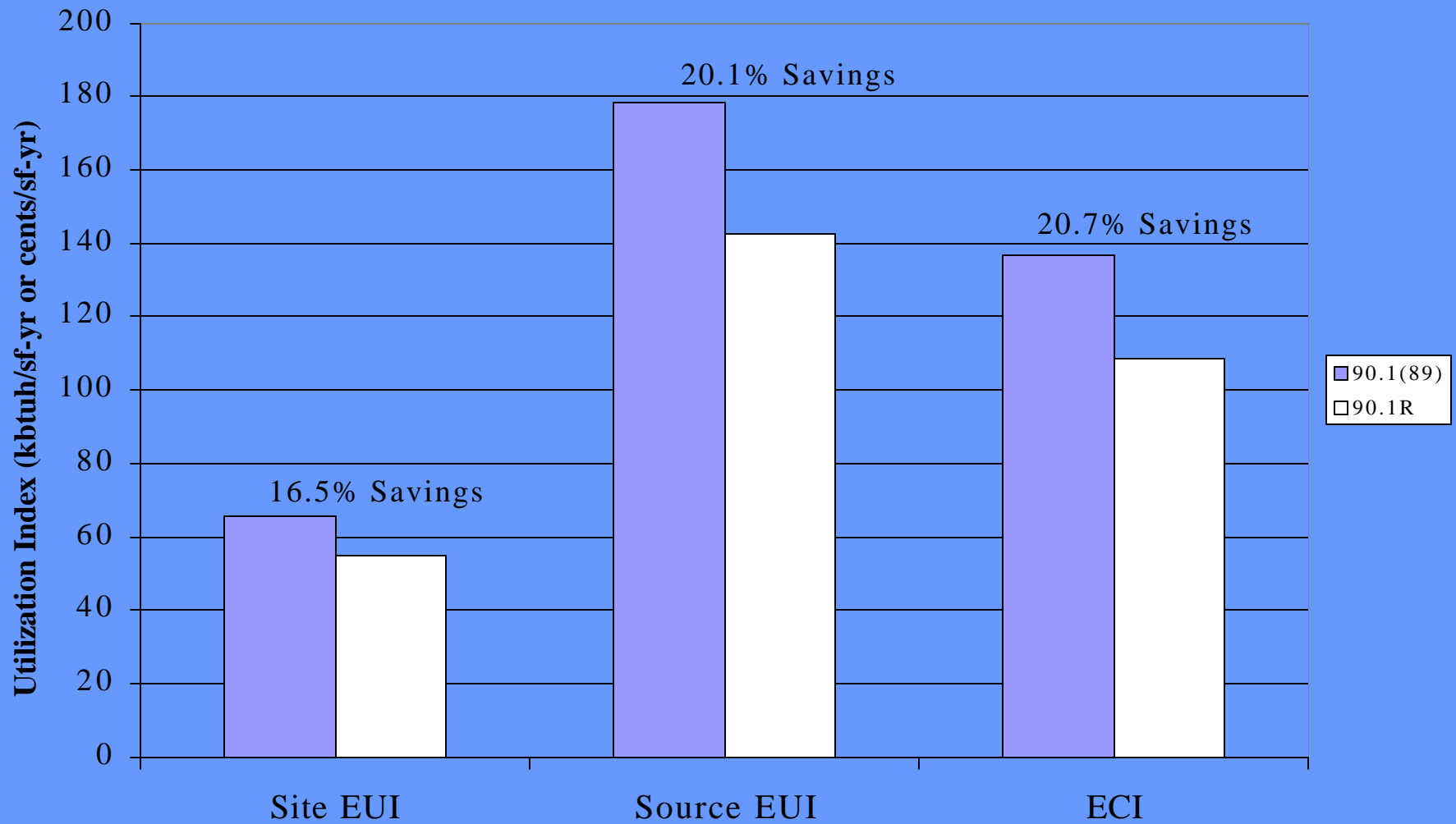
Office Versus Retail

- Results for office and retail, showing ECI comparison only
- Biggest savings are in retail, driven by lighting loads and hours of operation
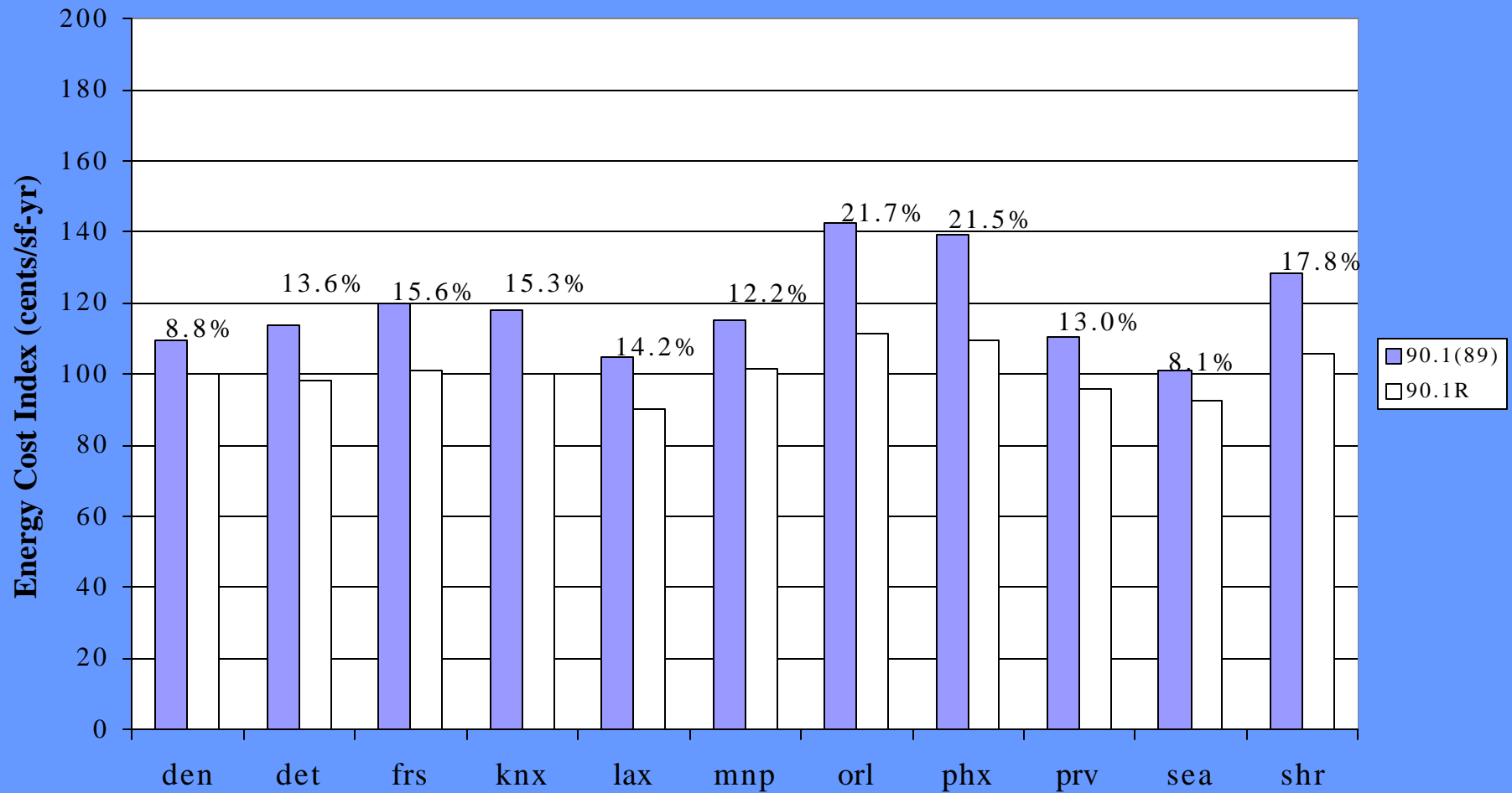
Office vs Retail Savings

Climatic Variation

- Results for 11 locations, showing ECI comparison for combined office and retail only

- Biggest savings are in warm humid climates, driven by changes in lighting, glazing requirements and cooling efficiencies
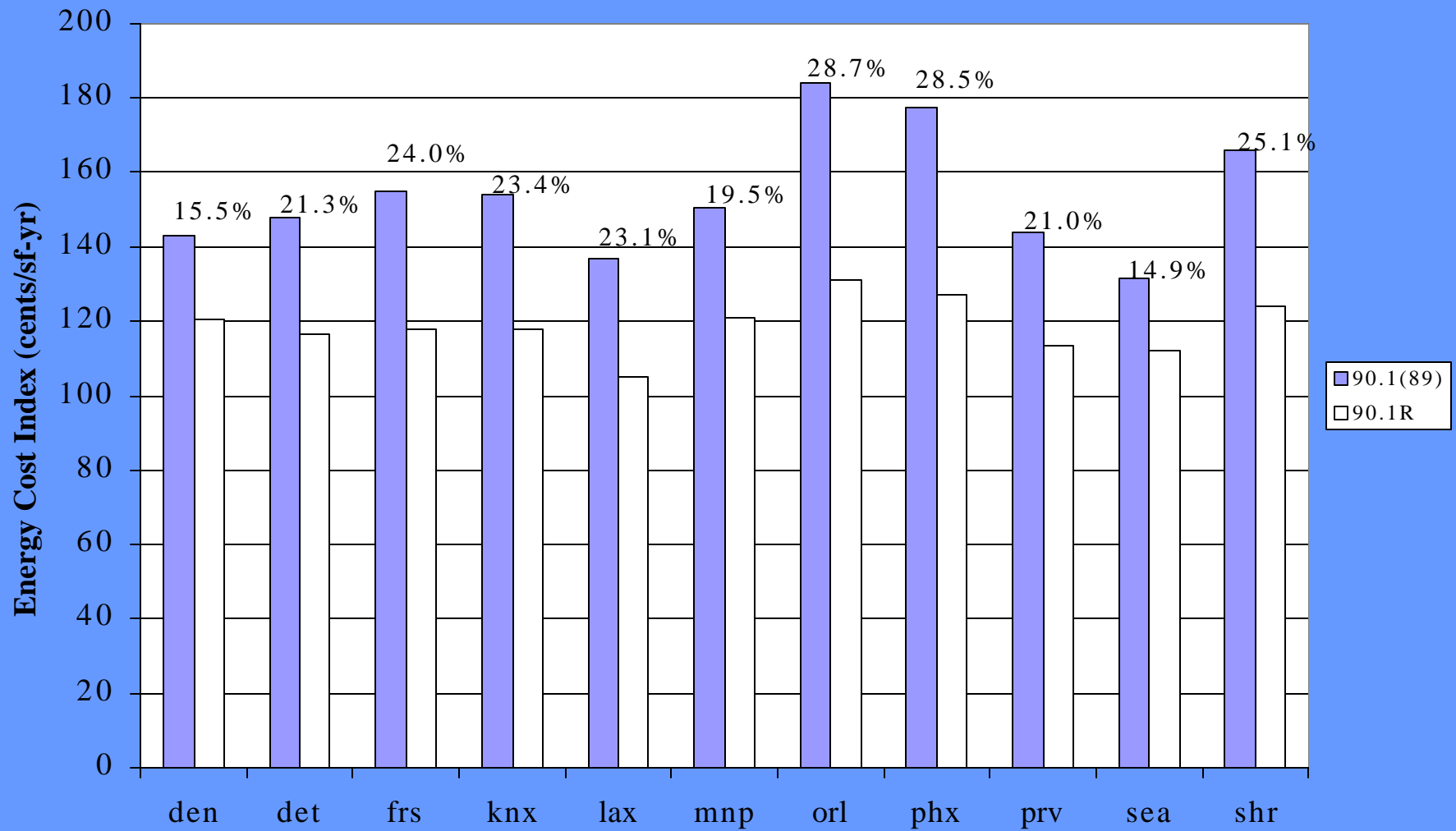
Climatic Variation (Office/Retail)
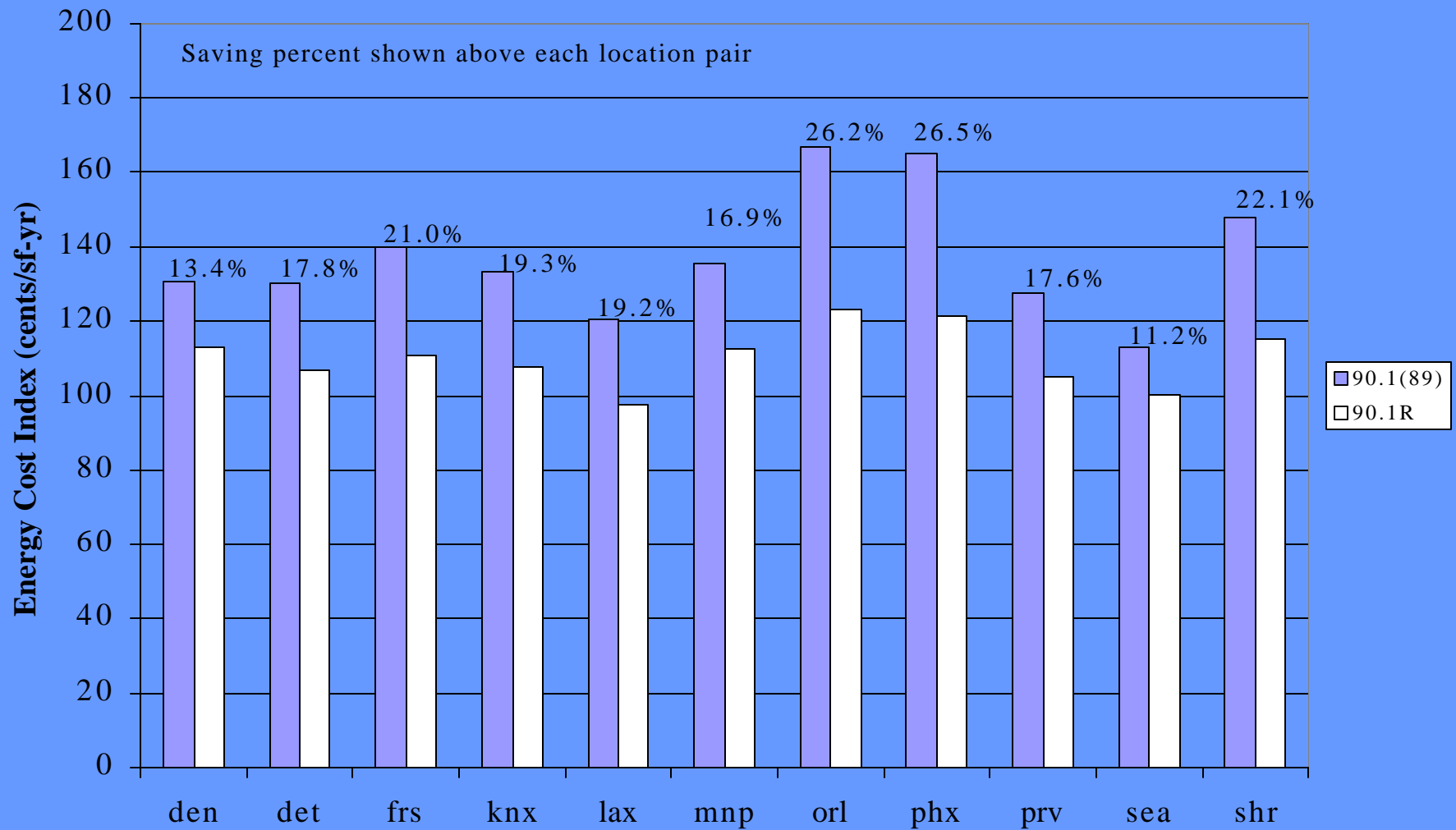
Climatic Variation (Office)

Climatic Variation (Retail)

What We Didn't Do

- ## Look at other building types
    - ### Warehouses - changes in lighting and envelope
    - ### *possibly no savings, but at low energy intensity*
    - ### Residential - changes in envelope
    - ### *savings dependent on building modeled*
    - ### Not in CBECS, but constr. info supplied by NMHC
- ## Look at other WWR
    - ### Looked at single common WWR (20%)
    - ### *Saving vary with WWR*

What We Didn't Do

- Look at large, central HVAC equipment
  - Economizers required more often for large systems in 90.1R
  - *Relative energy usage between standards will differ from that shown for packaged equipment and analysis is complex*

- Look at other assembly types
  - Only mass and metal frame walls with deck roof
  - *Higher savings likely with wood frame and attics, lower savings likely with metal buildings*

What We Didn't Do

- Look at impact of "envelope alone", "HVAC and SWH alone", "lighting alone"
  - Savings estimates based on whole building
  - *Savings from envelope minimal, significant savings from cooling equipment, minimal savings from heating and service water heating equipment, significant savings from lighting in most building types*

What **WE** Can Do

- Provide input parameters, input decks, detailed results

- Participate in discussions of additional simulations needed and of variations to existing simulations

What We Would Like **YOU** To Do

- Review results
- Review simulation inputs
- Provide constructive criticism
- Suggest additional simulations